Fishing in the Early Medieval Slovakia: A Case Study from Bajč

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The Site & Research Aims

The **multi-period** site at Bajč – Medzi kanálmi, situated in southwestern Slovakia (Komárno District), was systematically explored in **1987–1994** by the Institute of Archaeology of Slovak Academy of Science (Ruttkay 2002). Over five hundred settlement structures included dwellings (sunken houses), interior and free-standing ovens, storage pits, parching pits, and channels. Spread across a sand dune, formerly an island surrounded by river meanders (Fig. 1–2), this site represents the only so far **completely excavated** early medieval settlement in the country. Its architectural remains attest the unfortified character of the site. The earliest occupation (**Horizon I**), spanning from the second half of the 6th to the first half of the 7th century is characterised by simple early Slavic hand-made pottery (Prague type). From the second half of the 7th century to the first half of the 8th century (**Horizon II**) and the second half of the 8th century to the first half of the 9th century (**Horizon III**), a decorated wheel-shaped (Central Danube type) ceramics started to predominate. During these periods, the Avar ceramic types (e.g., baking bells) occurred, suggesting the eastern cultural influences or contacts. From the second half of the 9th to the second half of the 10th/11th century (**Horizon IV**) the pottery of a highest-quality firing and material is recorded. During this period, the occupation of the lower (southern) part of a dune vanished and only sporadic finds from later periods suggest gradual **nonviolent(?) abandonment** of the site.

Among artefacts, the cooking vessels, spinning whorls, simple bone tools, whetstones, millstone or simple metal tools connected to daily domestic tasks belong to the most abundant, suggesting the lower social status (**peasants?**) of the inhabitants. Nevertheless, men buried with swords and spurs in an adjacent burial ground also indicate presence of the local (regional?) **elites**. The ecofacts including animal bones and plant remains indicate a self-sufficient economy with a dependence on **arable** and **pastoral farming.** The locals cultivated cereals, mainly the barley and wheat (Hajnalová & Mihályiová 1994, 1995; Hlavatá 2008) and kept domestic animals. The animal husbandry was focused on cattle and caprines (Miklíková 2010). The horses were abundant and donkey were used. People also exploited the lowland **forests** and **riverine** (Žitava River) **biotopes** (Fig. 3). The otter, beaver, aquatic birds, pond terrapin, freshwater mussels and fish provided additional food and raw material resource .

Our research is aimed on providing the first insight into the local fish **consumption** and **fishing**. Was it just an occasional or a year-round activity? Which fish species were targeted? What was the size of the fish consumed? Can we trace any spatial or temporal changes in the represention of fish remains? Do the bones or scales provide some evidence on the way of procurement of fish or preparation of its meat?

Fig. 1. The site location within the lowlands of the Little Hungarian Plain.

Fig. 2. The settlement occupied an area of 35 000 m² on a former peninsula or an island surrounded by meanders of the Žitava River (© AÚ SAV Nitra).

Fig. 3. The site microregion on a map from 1789.

Tab. 1. The sampling and recovery of fish remains in particular year of the excavation. Highlighted is the season with examined scales. For abbreviations see the text below.

Excavation		Sampled features (n)		Samples (n)		Positive samples (%)		Positive features (%)		No of finds	
Season	*explored features	HR	F	HR	F	bone	scale	bone	scale	bone	scale
1987	52	34	–	57	0	3.5	–	5.9	–	3	0
1988	75	53	13	97	24	6.2	12.5	13.2	23.1	12	x
1989	44	30	16	72	27	9.5	0	10.0	0.0	3	0
1990	117	87	24	158	27	2.5	11.1	4.6	8.3	2	800
1992	104	74	19	137	22	4.4	59.1	4.1	68.4	2	x
1993	94	61	30	182	73	6.1	19.2	18.0	46.7	3	xxx
1994	81	64	44	158	87	8.9	29.9	18.8	59.1	48	580
Total	**567**	**403**	**146**	**861**	**260**	**5.5**	**22.7**	**10.4**	**39.7**	**73**	**1380**

Sampling & Recovery

Fish remains were recovered through two techniques: **hand-recovery** (HR) and **wet flotation** (F). The part of bones were hand-retrieved (HR = 43; 8.25 g) and remainder was collected through flotation of soil samples (F = 30; 1.41 g). The fish scales were retrieved by both methods (HR = 800; 2.85 and F 586; 2.65 g). A judgmental **sampling** strategy was targeted on collecting of finds from interesting features or layers and concentration of animal bones, shells or plant macro-remains visible by naked eye. During the flotation, the group of three sieves with the mesh size of 1, 4 and 0.25mm was used. Roughly, the infill of one third of the settlement structures was processed by flotation. The fish remains were sorting out from the hard residues and their presence was recorded in relative numbers: x – small number (up to 29 specimens), xx – medium number (30 to 59 specimens), xxx – large number (more than 60 specimens). During our research, part of recovered samples were not on disposal (**24% of bones** and **51% of scales**). Their evaluation is based on archaeobotanical records only (Tab. 1).

Fish Representation & Size Estimation

Altogether **twelve** species and five families of the ray-finned fishes (Actinopterygii) were identified in the assemblage. All are **freshwater** and **indigenous** to Slovakia (Tab. 2). A balanced representation of limnophilic and rheophilic taxa indicate the exploitation of both **lentic** (e.g. ponds, seasonal pools, swamps, bogs, or lakes) as well as **lotic** water **ecosystems** (flowing waters such as creeks, brooks, spring, streams and rivers). In contrast to modern fish populations of the lower Žitava River (Hajdú/Pekárik 2009), a higher diversity of rheophilic fish sensitive to oxygen saturation and pollution of water (e.g., sterlet, wild carp, perch) is observed. The majority of bone specimens belong to the culinary valuable adult fish, among which pikes and carps with sufficient length prevail (74% of NISP).

The fish size estimation followed the formulas of **V. Radu (2003)**. A big pikeperch and common carp (1 m/10–16 kg) were present. The recovered carp bones are comparable in size to early medieval or Early Modern sites (Fig. 4). Smaller fish (TL up to 35 cm) such as dace, roach, orfe, rudd, or undermounth are identified only by scales. (Tab. 2). Regarding culinary practices, the only evident **cut mark** is recorded on a sterlet *cleithrum* (see bone pics). The possible processing of **dried fish** (e.g. smoked, air-dried, fermented) is indicated by the occurrence of several species with different season of death (caught from early spring to summer end) within a single context (e.g., settlement pit 757). The highest number of fish bones represent the earliest phase of the settlement existence (Fig. 5). In the following periods, fish bone were represented by ca 1% of total NISP. On the contrary, most of the scales come from later periods. The spatial element analysis showed that the scales are clearly related to **parching pits**. Only in here also occurr the fin and tail elements, suggesting this might be an initial place for **fish processing** or culinary preparation of its meat (site plan below).

*Tab. 2. Fish species identified in Bajč with its biological (Holčík & Hensel 1972) and contextual information. Abb.: **rheo**phylic, **lim**ophilic, **li**tophilic, **phyt**ophilic, **T**otal **L**ength, **W**eight, *single vertebra.*

Taxonomy		Body size		Life span	Ecology			Dating (century AD)						NISP	NISP	Estimated fish size and age				
Common name	Latin name	max TL (cm)	max W (kg)	max (yrs)	Habitat	Spawning	Season	7–8	8	8–9	9	9–11	Slavic	bone	scale	TL mean (cm)	TL Min–Max	W mean (kg)	W Min–Max	Years at death
Sterlet	*Acipenser ruthenus*	100–125	16	22	rheo	li	April – May	–	–	–	1	–	–	1	–	–	69.7	–	1.79	–
Pike	*Esox lucius*	120–160	15–50	33	lim	phyt	March – April	5	2	3	3	1	–	14	–	50.0	32–62.1	1.21	0.66–1.96	5–18
Roach	*Rutilus rutilus*	35	1–2	20	rheo	all	April – May	–	–	1	–	–	–	–	1	–	21.3	–	0.12	3
Dace	*Leuciscus leuciscus*	20–25	0.4	10+	rheo	li	March – May	–	–	1	–	–	–	–	1	–	28.1	–	0.16	8
Orfe	*Leuciscus idus*	35–50	2–8	10	lim	li	April – May	1	2	–	1	2	–	2	1	23.9	30.8–35.2	0.12	0.33–0.55	6
Rudd	*Scardinius erythrophtalmus*	35	0.4	15	lim	phyt	May – July	2	–	–	–	–	–	–	2	–	17.9–23.5	–	0.07–0.18	3–5
Undermounth	*Chondrostoma nasus*	30	2.5	15+	rheo	li	April – May	–	–	2	–	–	–	–	2	–	21.6–23.0	–	0.05–0.07	3–4
Carp	*Cyprinus carpio*	100	20–30	28	rheo	phyt	March – April	4	1	1	4	3	1	14	–	60.6	32.7–104.4	4.93	0.54–16.70	(11*)
Catfish	*Silurus glanis*	200+	100+	30+	lim	phyt	May – July	–	1	–	–	–	1	2	–	–	79.1–101.2	–	3.34–7.00	–
Pikeperch	*Stizostedion lucioperca*	130	12+	15	lim	all	April – May	3	–	–	–	–	–	3	–	–	57.8–101.8	–	1.72–10.17	–
Perch	*Perca fluviatilis*	50	4	20	lim	all	April – June	–	2	–	–	–	–	–	2	–	14.5–21.9	–	0.03–0.13	3–4
Cyprinid	Cyprinidae	–	–	–	–	–	–	3	–	–	–	–	–	1	2	–	–	–	–	–
Fish	Pisces indet.	–	–	–	–	–	–	16	8	8	3	–	1	36	1364	–	–	–	–	–
Finds altogether		–	–	–	–	–	–	29	14	12	11	4	3	**73**	**1380**	–	–	–	–	–

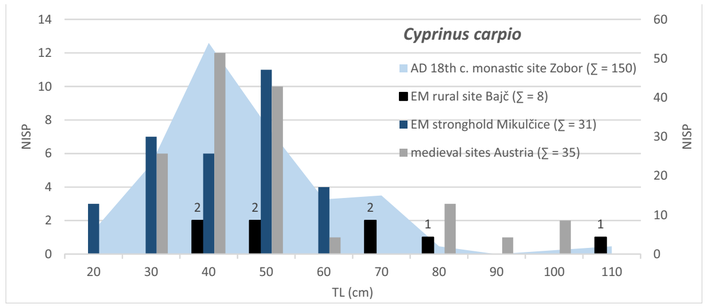


Fig. 4. The size of a common carp from selected medieval (Galik et al. 2015; Zawada 2003) and the Early Modern sites in Middle Europe (Bielichová et al. 2018).

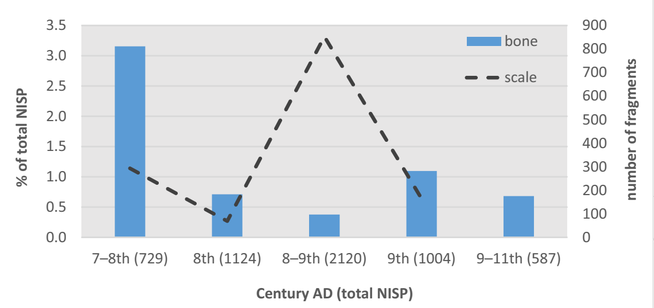


Fig. 5. The temporal changes in the representation of fish remains from Bajč.

Tab. 3. The intensity of the formation of the last annual ring on scales of modern species in the European part of Russia.

Number of scales with:	Species	January	February	March	April	May	June	July	August	September	October	November	December
Last annual ring **not showing growth** of the current year	*R. rutilus*	-	-	2	3	6	7	4	4	-	-	-	-
	S. erythrophthalmus	0*	0	-	1	2	5	5	7	-	-	-	-
	L. leuciscus	0	0	1	3	4	7	2	4	-	-	-	-
	L. idus	-	1	2	3	4	7	3	4	-	-	-	-
	S. cephalus	0	0	1	2	3	5	5	3	-	-	-	-
	Ch. nasus	0	0	-	1	2	2	2	3	-	-	-	-
	P. fluviatilus	-	1	1	2	4	7	4	4	-	-	-	-
Last annual ring showing **slight growth** of the current year	*R. rutilus*	-	-	-	-	-	1	5	5	6	2	1	-
	S. erythrophthalmus	0	0	-	-	-	-	3	2	5	2	-	-
	L. idus	-	-	-	-	1	2	7	5	-	2	1	-
	S. cephalus	0	0	-	-	-	2	3	3	1	1	4	-
	Ch. nasus	0	0	-	-	-	1	2	2	1	-	-	-
	P. fluviatilus	-	-	-	-	1	1	5	5	5	3	2	-
Last annual ring showing **intensive growth** of the current year	*R. rutilus*	10	10	-	-	-	-	1	1	4	8	9	10
	S. erythrophthalmus	0	0	-	-	-	-	-	-	5	8	7	5
	L. leuciscus	0	0	-	-	-	-	-	-	8	7	5	5
	L. idus	10	8	-	-	-	-	-	1	10	8	9	10
	S. cephalus	0	0	-	-	-	-	-	3	8	9	6	5
	Ch. nasus	0	0	-	-	-	-	-	-	4	5	5	5
	P. fluviatilus	10	8	-	-	-	-	1	1	5	7	8	10
Underdeveloped last annual ring	*R. rutilus*	-	-	8	7	4	2	-	-	-	-	-	-
	S. erythrophthalmus	0	0	10	9	8	5	2	1	-	-	-	-
	L. leuciscus	0	0	9	7	5	1	-	-	-	-	-	-
	L. idus	-	1	8	7	5	1	-	-	-	-	-	-
	S. cephalus	0	0	9	8	7	3	2	1	1	-	-	-
	Ch. nasus	0	0	5	4	3	2	1	1	-	-	-	-
	P. fluviatilus	-	1	9	8	5	1	-	-	-	-	-	-

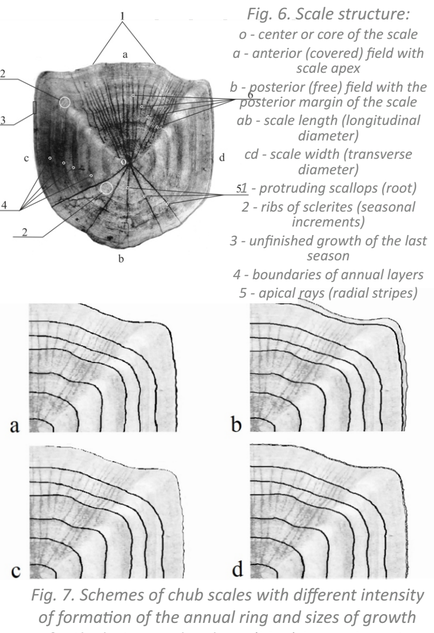


Fig. 6. Scale structure:
o - center or core of the scale
a - anterior (covered) field with scale apex
b - posterior (free) field with the posterior margin of the scale
ab - scale length (longitudinal diameter)
cd - scale width (transverse diameter)
s1 - protruding scallops (root)
2 - ribs of sclerites (seasonal increments)
3 - unfinished growth of the last season
4 - boundaries of annual layers
5 - apical rays (radial stripes)

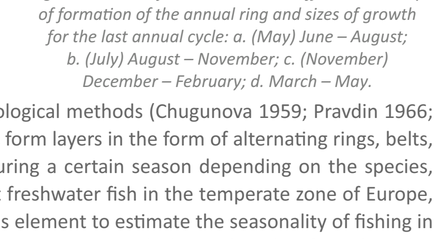


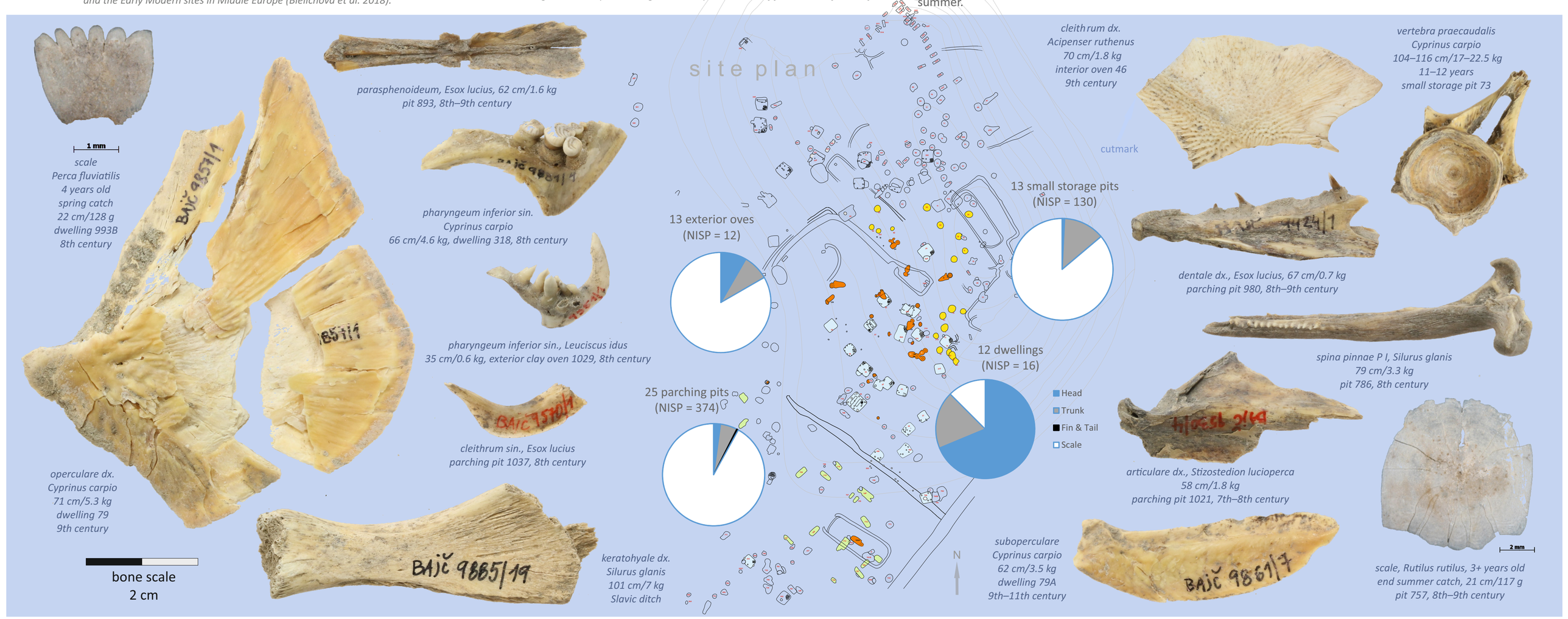
Fig. 7. Schemes of chub scales with different intensity of formation of the annual ring and sizes of growth for the last annual cycle: a. (May) June – August; b. (July) August – November; c. (November) December – February; d. March – May.

Seasonality

Determining the **age** of fish using scales followed the standard ichtyological methods (Chugunova 1959; Pravdin 1966; Panfili et al. 2002). The principle is based on the property of scales to form layers in the form of alternating rings, belts, planes and sclerites (Fig. 6). The annual rings are usually formed during a certain season depending on the species, temperature conditions, spawning time, or a feeding regime. In most freshwater fish in the temperate zone of Europe, **annual rings** form intensively over several months. In order to use this element to estimate the seasonality of fishing in Bajč, the ancient scales as well as relevant modern reference data of same taxa were used. The modern data from the Volga River basin and rivers and lakes from the Baltic Sea basin were grouped by 5-10 individuals, depending on the month of their capture and covering the entire annual cycle (Tab. 3).

The study along the **outer edge of the scales** showed that some fully developed rings were observed from March to May, but in majority, the initial ring formation took place from the end of March till May (Tab. 3: grey). Starting from August the growth increased and reached its peak in the end of November and in December (Tab. 3: blue). From the middle of December till February till beginning of March a stabilization of ring growth took place, i.e., the rate of change was the slowest (Fig. 7). Accordingly, it was possible to determine the **catch season** - before as well as after the formation of the last annual ring with a high probability.

The majority of Bajč fish were caught in the **summer** (10 scales), a fairly significant number in the **spring** (5 scales), and only one individual in the autumn. It can be concluded that the main fishing period was during the "open water" season, when lakes and rivers were free from the ice cover. The locals were fishing from **April** till **October**, mainly during the summer.



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